

### **REMARKS**

The present application had claims 1-3, 5 and 11-19 pending. Claims 1 and 3 have been amended herein and new claim 20 has been added. Accordingly, claims 1-3, 5 and 11-20 are presently pending.

Support for the amendment of claim 1 may be found on, *inter alia*, page 6, lines 13-19. The amendment to claim 3 is minor in nature. Support for claim 20 may be found in originally filed claim 3, as well as elsewhere in the specification. Neither the amendments of claims 1 or 3 nor the addition of claim 20 introduces new matter to the disclosure.

In the March 16, 2011 Office Action, the Examiner rejected claim 3 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite because of the phrase “such as”. Applicants have herein amended claim 3 to delete the criticized phrase, and added claim 20 directed to the deleted subject matter of claim 3.

Claims 1-3, 5 and 11-17 were also rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over EP 1 229 600 (hereafter EP `600) in view of Yamamoto, *et al.* (US 6,797,426). Applicants respectfully disagree with the Examiner’s positions.

Initially, Applicants point out that the present invention is now directed to membrane-electrode units (MEUs) for membrane fuel cells that are operated with unhumidified operating gases, i.e., in dry operating conditions (see e.g., the specification, page 6, lines 1-9, and claim 1). As set forth in the specification:

*“In the context of the present application, “operation with unhumidified gases” means that the fuel cell is operated with operating gases which are not additionally moistened by external apparatuses, i.e. which have a water content*

*which corresponds to that of the initial state or the state of use .... What is decisive is that an external humidifier (for example a "bubbler") is dispensed with here.*

(specification, page 4, lines 10-21) (emphasis added).

Accordingly, the present invention is now directed to MEUs that operate with dry, unhumidified gas and without external humidifiers. The present invention when incorporated into such fuels cells provide shorter start-up times for the fuel cells and improves performance (see the specification, page 7, line 30 to page 8, line 13). Applicants have herein specifically limited their invention to membrane electrode unit for membrane fuel cells operating with dry, unhumidified gases – see amendment to independent claim 1.

EP `600 is cited as the primary reference by the Examiner. The reference is discussed in the present application at page 5, lines 26-36. As pointed out in the specification, EP `600 does not disclose or discuss MEUs for fuel cells that operate with dry, unhumidified gases – as now required by the pending claims.

Moreover, EP `600 discloses MEUs in which the water repellency of the carbon material included in the cathode is higher than that of the carbon material included in the anode (see EP `600, section [0072]). This teaching is directly contrary to that of the present invention. The claims of the present application require that the amount of water repellent agent in the anode gas diffusion layer is identical or higher than the amount of water repellent agent in the cathode gas diffusion layer ( $WRA_{Anode} \geq WRA_{Cathode}$ ). Clearly EP `600 teaches away from this element of the invention.

In contrast, Yamamoto discloses MEUs in which the water repellency of the fuel diffusion layer (anode) is higher than the water repellency of the oxygen diffusion layer

(cathode) -- see col. 3, lines 58-65. This teaching is opposite of the teachings in EP `600.

Considering the contradictory teachings of the references, one skilled in the art would have no incentive or motivation to try to combine these references – in the matter done so by the Examiner. In fact, it is unclear to Applicants how one would even reconcile the contradictory teachings in such a combination.

Even if such a combination was possible and proper, one still would not arrive at the limitations of the presently claimed invention. First of all, there is no specific disclosure directing the skill person to fuel cells that operate with dry, unhumidified gases and without external humidifiers – as required by the claims. EP `600 is silent as to this aspect and Yamamoto shows no preference (see Yamamoto, col. 15, lines 36-39). Thus combining the references would not teach or suggest the claimed field of fuel cells that operate with dry, unhumidified gases.

Furthermore, the claim element requiring that ‘amount of water repellent agent in the anode gas diffusion layer is identical or higher than the amount of water repellent agent in the cathode gas diffusion layer’ would be missing. Since the references have contradictory teachings in this regard (one teaching that the cathode has a higher water repellency, while the other teaches that the anode has a higher water repellency), it is unclear how their combination would teach or suggest to one of ordinary skill, the claim element requiring that amount of water repellent agent in the anode gas diffusion layer is identical or higher than the amount of water repellent agent in the cathode gas diffusion layer.

Moreover, claim 1 of the present application requires that the amounts of water repellent agent in the anode and the cathode gas diffusion layers be in the range of 20 to 35% by weight (based on the total weight of the gas diffusion layer). Neither EP `600

nor Yamomoto teaches this claim element. As pointed out by the Examiner, EP `600 fails to disclose this element (see page 4, last paragraph, of the Office Action).

Yamomoto, on the other hand, gives a very broad range of 20 to 80 wt.% for the anode and a range of 15 to 65 wt.% for the cathode (see Yamamoto, col. 1, line 65 to col. 2, line 3, and claims 5 and 6). There is nothing in Yamamoto that would direct one of ordinary skill to use an amount of water repellency in the gas diffusion layers in the range of 20-35% by weight.

Additionally, the claim element requiring that the gas diffusion layers on the anode side or the cathode side comprise a microlayer having a layer thickness between 10 and 20 microns is not taught or suggested by the references – either alone or in combination. As pointed out by the Examiner, EP `600 fails to teach this claim element at all (see page 5 of the Office Action). In Yamamoto, Figure 1 shows the fuel diffusion layers (42) and (52), each comprise one or two microlayers (anode: 423 and 422; cathode: 522 and 523).<sup>1</sup> Yamamoto discloses a very broad range for the layer thickness of the microlayer (2 to 100 microns) and teaches that the thickness of the microlayer is "not particularly limited" (see Yamamoto, col. 5, lines 59-63). Thus there is no incentive or suggestion in either reference to use a microlayer having a layer thickness of 10-20 microns – as required by the claims.

In the March 16<sup>th</sup> Office Action, process claims 18 and 19<sup>2</sup> were rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over EP `600 in view of Yamamoto and further in view of Iwase et al. (6,245,453).

Iwase teaches the use of dry gases as an option to humidified gases. Both operating conditions are reported. It should be noted, however, that the described dry gas

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<sup>1</sup> In the terminology of the present invention, the anode gas diffusion layer (GDL) would be equivalent to layer 421; the cathode gas diffusion layer (GDL) would be equivalent to layer 521 of Yamamoto.

operation of Iwase still requires a humidity of the fuel gas of 100% -- only the air side (cathode side) is not humidified. See Iwase, col. 12, lines 40-45; specifically, line 44-45: "... using dry gas (humidity of the fuel gas and oxygen-containing gas were 100% and 30% respectively)". Thus the skilled person upon reading Iwase would not consider "providing or feeding dry, unhumidified gases to the anode and cathode of the membrane electrode unit" – as required by claim 18 (emphasis added). In the present invention unhumidified gases are fed to both the anode and the cathode side.

The remaining pending claims of the present application all depend from, and contain all the limitations of, independent claim 1, and thus are patentable over the cited references for the same reasons as outlined above.

In sum, a skilled artisan in the art field would not arrive at the presently claimed invention based on the teachings of the cited references, either alone or in combination.

In light of the amendments and remarks above, Applicants request reconsideration and withdrawal of the rejections set forth in the March 16, 2011 Office Action and respectfully solicit allowance of the present application.

No fee is believed to be required in connection with the filing of this response, other than the fee for the requested two-month extension of time. If any fee is deemed necessary, authorization is hereby given to charge the amount of any such fee to Deposit Account No. 50-5371.

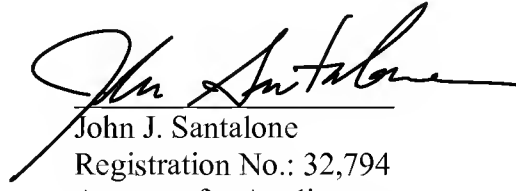
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<sup>2</sup> In the March 16, 2011 Office Action, the Examiner actually rejects claims 9-10. Applicants assume that the Examiner intended to reject claims 18 and 19 since claims 9 and 10 have previously been canceled.

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If the Examiner has any questions regarding the present application, the Examiner is cordially invited to contact Applicants' attorney at the telephone number provided below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "John J. Santalone", written over a horizontal line.

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